Supplementary Information
for

Water-Penetration-Assisted Mechanical Transfer of Large-Scale Molybdenum Disulfide onto Arbitrary Substrates

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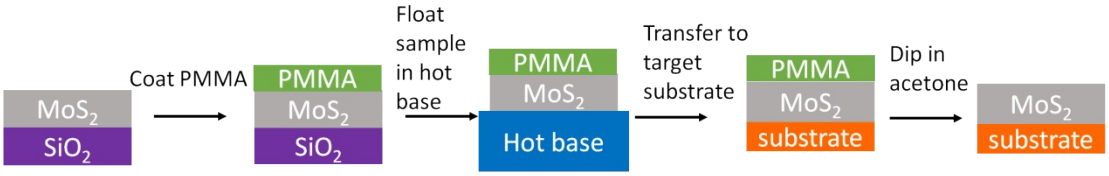

Fig. S1. Process of common solution etching method.

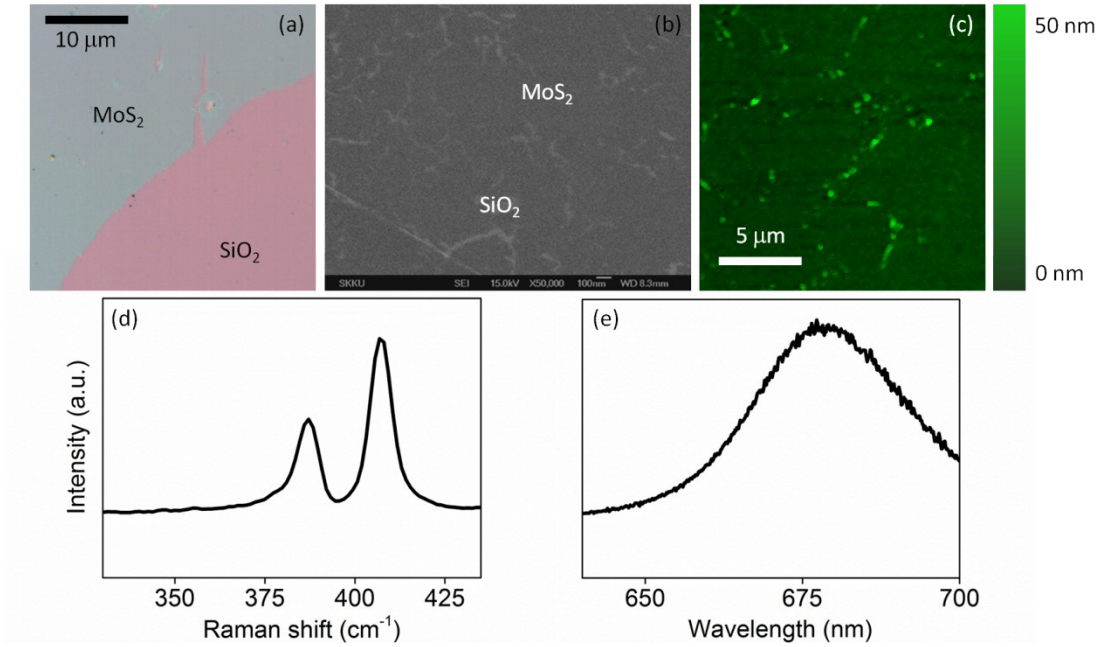

Fig. S2. OM image (a), SEM image (b), AFM image (c), Raman spectrum (d) and PL spectrum (e) of MoS_2 on SiO_2 transferred with common solution etching method.

The transfer process of common solution etching method was shown in Fig. S1. After transfer, PMMA polymer residue was observed in Fig. S2a and S2c as polymer carrier film cannot be completely removed. In Fig. S2b, wrinkles and microcosmic cracks were observed in SEM images, which is due to the locally generated strain. PMMA cannot afford robust mechanical support for MoS_2, thus it is inevitable to introduce strain into MoS_2 layer during this PMMA-mediated transfer process.[1] Raman peak positions in Fig. S2d were down-shifted about 1 cm^{-1} compared with samples in Fig. 3 in manuscript, due to local strain and/or doping effect from PMMA residues. PL peak in Fig. S2e was also up-shifted about 10 nm.

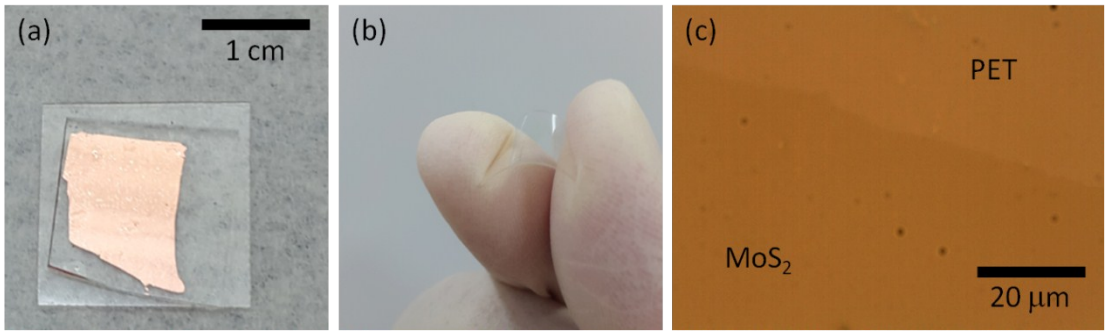

Fig. S3. Optical images of PDMS/PMMA/Cu/MoS_2/PET sample (a), MoS_2 on PET (b) and OM image of transferred MoS_2 film on PET substrate (c).

We transferred MoS_2 to PET substrate, which is widely used as flexible substrate for various applications, by simply replacing SiO_2 target substrate with PET following the same process in Fig. 1. Fig. S3a and S3b clearly show the successful transfer of large-area MoS_2 film onto the PET substrate. Fig. S3c shows the perfect uniformity and cleanness of the transferred MoS_2 film.

References

1. D. L. Ma, J. P. Shi, Q. Q. Ji, K. Chen, J. B. Yin, Y. W. Lin, Y. Zhang, M. X. Liu, Q. L. Feng, X. J. Song, X. F. Guo, J. Zhang, Y. F. Zhang and Z. F. Liu, *Nano Res*, 2015, **8**, 3662-3672.
2. Z. Y. Lin, Y. D. Zhao, C. J. Zhou, R. Zhong, X. S. Wang, Y. H. Tsang and Y. Chai, *Sci Rep*-

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